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THE MORTALITY FROM RESPIRATORY DISEASES IN THE GLASS INDUSTRY*

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GLASSWORKERS are employed in what is notoriously an unhealthy occupation, but it is quite erroneous to classify all glassworkers alike and to apply this description to the industry as a whole. Furthermore, earlier conclusions must be materially modified in the light of subsequent experience, for what was true thirty years ago is today but in part applicable to a relatively small group of men employed in particularly hazardous occupations. The latest census data give the number of persons employed in the glass industry as 78,804, of which 74,502 are wage-earners, or about 6,000 more than five years earlier at the time of the census of 1909. The increase in the number of wage-earners in the glass industry has not been as rapid as the growth of the industry in other respects, largely because of the modern tendency to substitute mechanical devices for human labor wherever that is possible. A further and even more important reason for the relatively slow increase in the number of persons employed is the replacement of old-style pot furnaces by more modern tank furnaces, which employ, in proportion to the product, a relatively smaller number of men.

The glass industry, broadly speaking, is divided into (1) plate glass, which includes window glass, plate glass, and all varieties of cast and roll glass; (2) pressed and blown glass, such as table ware, glasses and tumblers, lamp chimneys, globes, etc.; (3) cut glass; and (4) bottles, jars, demijohns, etc. Each of these major branches has its own peculiar health hazards or its own conditions which more or less safeguard or predispose for or against disease liability, particularly the mortality from tuberculosis and respiratory diseases. It does not fall within the province of this discussion to present, even in outline, a descriptive account of the numerous glass-making processes, though it may be said that there is a regrettable absence of technical works useful for the purpose of gaining an accurate understanding of the health hazards in their relation to highly specialized processes. The earlier works of reference which are generally relied upon are no longer applicable to the purpose, for a modern glassworks, although conforming in some respects to the industry as it has been carried on for ages, is nevertheless fundamentally differ-

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ent, at least as regards health and life, from the glassworks of the past.

A second and equally important consideration is the very material improvement in the quality of labor employed in the glass industry. Long before the advent of prohibition there had been a decided improvement in the habits of the men in the direction of a lesser liability to drunkenness or gross intoxication, which in itself is a predisposing cause to disease, particularly lead poisoning and tuberculosis.

Life insurance companies have at all times taken a serious view of this occupation; such investigations as have been made have almost invariably disclosed a higher mortality than that met with among the artisan element generally. Twenty years ago practically all glassworkers, or at least blowers and gatherers and men employed in the manufacture of cut glass, such as cutters, polishers and pressers, were either declined or charged extra premium rates, practically prohibitive. By 1903 rates had generally improved, although even now (in 1920) they are still excessive for some employments and, for some occupations, prohibitive because of the probably continued existence of conditions inimical to health and life. These conditions apply particularly to mixers and handlers of materials on account of the exposure to mineral dust, the mechanical and chemical properties of which unquestionably predispose to silicosis and a resulting true pulmonary tuberculosis. Comparing 1903, however, with 1919, it will be sufficient for the present purpose to give the extra premium charges on a whole life policy for $1,000 at age 35. These charges have nearly all been modified for the better — so much so that while in most occupations higher charges continue to be made they are now easily borne, considering the advantages gained by life-insurance protection on the legal reserve plan. A blower, for illustration, would have been declined entirely in 1900, but was accepted in 1903 at intermediate rates, or say $5.91 extra per $1,000. By 1919 intermediate rates had been reduced to special rates, or $2.77 extra per $1,000. A batch wheeler, acceptable at intermediate rates in 1903, was accepted at medium rates in 1919, or at a reduction of from $5.91 to $5.67 extra per $1,000. Occupations such as mixers and handlers of material continue to be declined; but in plate-glass making bevelers, formerly charged special rates, or $3.16 extra per $1,000, are now accepted without rating.

Perhaps the most important changes have been made in the case of the glass-cutting industry which was formerly considered particularly hazardous on account of the liability to lead poisoning — a liability which has, however, been practically done away with. Glass cutters and polishers in 1900 were charged an extra premium of $6.35 per $1,000 on the intermediate plan and $5.92 in 1908, but they are now accepted without rating. Roughers and smoothers, who were formerly charged intermediate rates, or $5.92 extra per $1,000, are now accepted without rating. Only puttyers continue to be declined, but it is quite probable that further investigations may disclose that earlier hazards of dampness, liability to lead poisoning, and dust have largely been done away with. It may at first seem that the dust hazard in wet polishing should be negligible, but the difficulty is that a large amount of dust accumulates about the shop as the result of drying, contaminates the atmosphere, and predisposes to dust phthisis.

The reduction of insurance rates is gratifying evidence of the sanitary progress in the glass industry, and suggests the desirability of a much more thorough investigation than has thus far been made into a subject of special interest to all who are concerned with the larger problem of pneumonoconiosis and dust phthisis. The evidence, however, is entirely conclusive that the

general mortality from pulmonary tuberculosis continues to be excessive among glassworkers as a group, and particularly among glass blowers separately considered, as well as among glass polishers.

The statistical evidence on this question is quite convincing. According to the industrial mortality experience of the Prudential, glassworkers during the period 1914–1918 experienced a proportionate mortality from pulmonary tuberculosis equivalent to 26.3 per cent. of the mortality from all causes, which compares with 12.3 per cent. for the practically corresponding period of the registration area. This excess, however, shows a diminution from 31.8 per cent. for the earlier period of 1897–1914, and particularly so at the important age period 25 to 34. Considering glass blowers only, it appears that the proportionate mortality from pulmonary tuberculosis was 32.1 per cent. during the period 1897–1914, and that by 1914–1918 this had diminished to 25.9 per cent. The mortality at the age period 25 to 34 diminished from 53.3 per cent. during the earlier period to 39.7 per cent. at the present time, but the excess even at the last-named period is clearly emphasized by the comparative figure for the registration area, which was only 29.5 per cent. It would seem, therefore, a safe conclusion that, while progress has been made in the direction of a diminishing mortality from pulmonary tuberculosis among glassworkers, the reduction has not been proportionately as large as the general progress in the prevention, treatment and control of the disease would seem to justify.

I had occasion to discuss this question, first, in my work on *Consumption in Dusty Trades*, published by the United States Bureau of Labor in November, 1908, and, second, in my *Mortality from Respiratory Diseases in Dusty Trades*, published by the same authority in June, 1918. On neither occasion could I enlarge upon the details of an industry which, as I have said before, has never been the subject of a really thoroughly qualified investigation. It may be recalled that in 1906 the president of the Glass Blowers' Association of America, Mr. Dennis A. Hays, read an interesting paper before the American Academy of Political and Social Science on the length of the trade life in the glass-bottle industry. Unfortunately this paper did not contain the statistical evidence which would have been useful in encouraging authorities on occupational diseases to give extended consideration to the subject; in fact, no one has as yet contributed the results of an extended statistical inquiry into the actual facts of mortality experience. Fragmentary references are to be found in *Diseases of Occupation* by Sir Thomas Oliver (page 377 *et seq.*) where attention is called to " the great amount of dust being blown about in the neighborhood of the furnaces," although this particular reference applies to injuries of the eyes. W. Gilman Thompson in his *Occupational Diseases* gives some interesting illustrations of actual processes, but brings forward no new data derived

TABLE 1.—PROPORTIONATE MORTALITY FROM PULMONARY TUBERCULOSIS AMONG GLASSWORKERS

(Industrial experience of Prudential Insurance Company, 1914–1918, compared with that of all males in the United States registration area, 1914–1917, by age groups.)

Age at Death	Deaths of Glassworkers 1914–1918 from		Per Cent. of Deaths from Pulmonary Tuberculosis among	
	All Causes	Pulmonary Tuberculosis	Glass-Workers	Males in Registration Area 1914–1917
15 to 24	136	36	26.5	26.0
25 to 34	212	82	38.7	29.5
35 to 44	148	52	35.1	22.6
45 to 54	117	27	23.1	13.8
55 to 64	124	14	11.3	7.3
65 and over ..	78	3	3.8	2.2
Total, 15 and over	815	214	26.3	12.3

from modern experience in support of the important conclusions advanced. The most recent work on the subject, *Diseases of Occupation and Vocational Hygiene* by Kober and Hanson, contains only a few references to the subject, chief emphasis being placed upon glass blowers' cataract, which, it may be said in this connection, is a strictly occupational affliction and should in every case be brought within the scope of workmen's compensation laws. The only really useful data derived from trade-union experience are contained in the report on *Women and Child Wage-Earners in the Glass Industry*, issued as one of the volumes of a larger inquiry made by the Bureau of Labor Statistics, and published as a Senate document in 1911. This experience has been referred to in my own discussion issued by the Bureau of Labor in 1918. It will be sufficient for the present purpose to point out that the proportionate mortality from pulmonary tuberculosis among a total number of 898 deaths from all causes was 31.96 per cent., or, if all deaths from tuberculosis are considered, 32.8 per cent. In addition, the proportionate mortality from non-tuberculous respiratory diseases was 10.8 per cent., so that of the total mortality from all causes, 43.6 per cent. was due to respiratory diseases of the tuberculous and of the non-tuberculous type. It is most regrettable that this interesting experience should not have been made the subject of further study carried on by modern methods of scientific research.

What may be done in this direction is best illustrated by the research work of the committee on dusty trades of the National Tuberculosis Association, for the time being limited to granite workers in Vermont. This investigation is being carried on in co-operation with the state board of health, the state tuberculosis association, the state sanatorium, the state manufacturers' association, the Vermont branch of the International Granite Cutters' Union, the state commissioner of industries, the state commission on dusty trades, local physicians and experts from other parts of the country, including the Trudeau Foundation of Saranac Lake. The investigation has been chiefly concerned with an analysis of the actual mortality experience, including, in the case of the labor union, a period of more than twenty years and covering the entire United States for the purpose of control. An analysis has also been made of the total mortality of Washington County, amplified by personal inquiries of every man employed in granite cutting at the present time, and by special reports upon the place of employment, the home, and the physical condition of the workman as disclosed by a thorough examination, including an x-ray of the chest.

The results of this investigation are so extremely suggestive that it is to be hoped that they may prove a model for subsequent similar inquiries into other trades. For granite workers, at least, the evidence is absolutely conclusive that the mortality from pulmonary tuberculosis has increased approximately three times the rate prevailing twenty years ago, although in the meantime the corresponding mortality of males, aged 20 years and over, in the state of Vermont has been reduced to one-half. The cause of this enormous increase is directly attributable to the increasing use of pneumatic tools producing an extremely fine dust, the ultra-microscopical particles of which are most harmful to the lungs. The dust particles produce a condition of pneumonoconiosis which in course of time results in a superinduced true tuberculosis. The most extraordinary result of these investigations is the disclosure of the fact that it takes approximately twenty-one years before the maximum effect is produced, and that comparatively few deaths from pulmonary tuberculosis occur among men exposed to granite dust during the first ten years of their employment. This inves-

tigation would have been inconclusive but for the generous aid of the International Granite Cutters' Union, which placed its entire records before the committee for independent re-examination and analysis. The results, however, even then would have had little more than academic value if it had not been for the willingness of the labor union to have its entire membership submit to a physical examination, including an x-ray of the chest, to determine the true extent of lung injury as the result of continuous and considerable dust exposure. It is anticipated that probably not less than 1,200 examinations will be made, and it is most gratifying to be able to say that the labor union has unanimously voted to assess itself $1.00 per capita as its share of the expense of this useful investigation.

In view of the excessive mortality from pulmonary tuberculosis and possibly from non-tuberculous respiratory diseases among certain occupations in the glass industry, it would seem of equal importance that a corresponding investigation should be made into the glassworkers' trade. There should be no difficulty in securing a similar whole-hearted co-operation on the part of the state authorities, the manufacturers, and the labor unions, the assistance of all being absolutely indispensable if the best possible results are to be obtained. All of the information secured in such an investigation concerning individual establishments or individual employees is considered strictly confidential, since it is only the collective results that are of most value for teaching or remedial purposes.

The glassworkers' trade is one of the most indispensable and useful occupations known. The prolongation of the glass-worker's life and the prevention of needless disease is, therefore, an important duty of the state and of all voluntary health-promoting agencies which can aid an effort first to ascertain the facts, and then to apply the resulting conclusions for the purpose of bringing about a better state of things. It is sincerely to be hoped that such an investigation will be made so that the facts may be known and, if conditions prove to be better than assumed, a further reduction in extra premium charges for life insurance may accrue to the benefit of wage-earners in the glass industry, and material restrictions may be removed in the case of occupations at the present time considered doubtful.

SURGERY AND INCREASED PRODUCTION*

An Indication of the Methods Available to Decrease the Economic Loss Due to Industrial Injuries

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THE economic problems of today are, to a large extent, due to decreased production. While other elements enter into the continually increasing cost of living, such as better living conditions, love of luxury, and social unrest, the high prices are largely due to the fact that for a period of two years a large percentage of the world's population was either in the military forces, and consequently non-producing, or else was engaged in making war supplies which have little utility in time of peace.

The conservation of the man-power of the nation is, in part at least, the duty of the physician and it is necessary that members of the profession recognize this fact and make a concerted effort to decrease the actual loss of productivity due to injury and disease. They may accomplish this both by the effective use of professional skill and by timely instruction and advice given to the employers of labor and workers in industry.

Surgeons have previously taken comparatively little consideration of the element of time in the treatment of injury. In general it was thought desirable to effect a cure as soon as possible, but the main consideration was, and still is, a good functional and anatomical result. Recently, however, surgeons employed in industrial organizations have come to realize that the time element is an important factor and when totally disregarded leads, in the sum total, to enormous losses both to employers and to employees, and, of course, in turn to the community.

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Accident surgery is practised today not only by the industrial surgeon — that is, the surgeon especially interested in industrial accidents and their relation to a given industry — but also by general surgeons, many of whom have little or no interest in the subject from an industrial standpoint. For this reason the economic side of the problem often receives scant consideration and, while the surgical results may be excellent, they are no better than those which might have been obtained by the industrial surgeon with a considerable saving in both time and money. It is not intended, of course, that a man physically unfit should be returned to work which he is unable to perform. All that is desired is that the time element shall be taken into consideration and measures instituted to adopt that form of treatment which, other elements being equal, will result in the shortest period of disability and the smallest economic loss to the community.

Prevention of Accidents

Much can be accomplished toward the prevention of accidents by proper advice at the time of employment. When an applicant for a position is examined, the physician can, by his advice, indicate both to the employer and to the prospective employee the work for which the applicant is best fitted. Many accidents have been caused by defective vision or by some other form of disability which rendered the man unfit for certain extra-hazardous occupations. Even so simple an affection as flat-foot may be associated with excessive

fatigue, causing a misstep or a false movement which may result in serious injury.

The industrial surgeon should keep careful records not only from a professional standpoint but also from an industrial standpoint, indicating the cause of the injury and the manner of its occurrence so that necessary safety devices may be installed to prevent recurrence. It is neither necessary nor desirable that the surgeon actually have charge of the installation. It is merely required that he indicate the need, leaving the methods employed to others who are better qualified. Under the present compensation laws every injury means a loss to the insurance carrier so that there is a financial incentive on the part of the employer to take every reasonable measure to reduce the occurrence of avoidable accidents.

The Immediate Care of the Injured

Here the element of time is of the utmost importance. Every injury should receive skilled treatment at the earliest practicable opportunity. Many comparatively insignificant injuries, unless adequately treated, become infected, resulting either in a long, drawn out period of convalescence or permanent disability. From a practical standpoint this need is being met in large organizations by the application of a first-aid dressing at once, combined with immediate treatment at the plant dispensary. This plan has been followed by very satisfactory results.

In the smaller industries where the employed are too few in number for the employment of a company surgeon, there is no definite plan which is generally carried out. The injured workman may receive first aid but he seldom sees a physician until several hours after the injury has occurred. Because of the inconvenience and loss of time, most minor injuries are apt to receive unskilled treatment or none at all. The need of skilled treatment in such cases might be met by the location of dressing stations serving certain localities, each of which would have a trained nurse on duty during the ordinary business hours. A physician would be on duty a portion of the day and would be on call for accidents occurring during his absence. Such a plan would be a great improvement upon the present practice of sending such cases to physicians who are often at a considerable distance from the place of injury.

Methods of Treatment

The method of treatment should receive critical consideration not only as to ultimate cure but also in reference to length of the period of disability. First-aid treatment when applied by semi-trained volunteer workers, in the case of abrasions and wounds, should be limited to the use of measures to prevent hemorrhage and the application of a sterile dressing, after preliminary use of tincture of iodine. Tincture of iodine is now fairly generally adopted as a first-aid dressing, especially when the dressing must be applied at a first-aid station some distance from the office of the surgeon.

Every accidental wound should be considered an emergency operation. A few will require no further treatment after the preliminary use of iodine; most will require a few skin sutures in order to hasten healing; serious or extensive wounds call for skilled surgical judgment and often considerable operative ability. Extensive wounds should be carefully explored, all foreign bodies removed, devitalized tissue excised, well swabbed with tincture of iodine and closed without drainage. This statement is made advisedly and in spite of the fact that in war surgery it was considered wise to leave all wounds widely open. The conditions under which indus-

trial wounds occur are almost entirely different from those associated with battle injuries. Only in the exceptional case should the wound be left open. For example, primary suture is not advisable in wounds where dirt from the street has been ground into the wound, where tetanus infection may be expected, and where foreign bodies cannot be thoroughly removed.

The treatment of infections due to neglected wounds should be promptly and carefully carried out. Lymphangitis and beginning cellulitis should be at once admitted to the hospital and receive active treatment. Whether incision, hot boric acid, Dakin's solution, or cold applications are to be used in these cases depends upon the preference of the individual surgeon. Any of the ordinary methods of treatment will in most cases lead to rapid improvement. Neglect will often lead to spreading cellulitis and permanent disability. Dr. Harry E. Mock * gives some interesting statistics which compare ambulatory and hospital treatment of hand infections. In a series of cases the average loss of time for all hand infections treated as ambulatory cases was 11.02 days, while under hospital treatment the average loss was 7.4 days. He states that every hand infection which showed evidences of becoming at all serious or threatened complications was sent at once to the hospital. If this system is adopted it will greatly increase the first cost of medical care but its saving in loss of time and prevention of permanent disability should more than compensate for the increased cost.

The treatment of fractures must be somewhat modified in order to decrease the period of disability. It is not sufficient to splint the fractured bone for from six to eight weeks and then to turn the patient loose to convalesce for six to twelve weeks longer. There is no doubt that massage, active and passive motion, properly applied heat and, in some cases, electrical stimulation will materially decrease the period of disability following simple fractures. In selected cases the use of traction apparatus properly controlled by repeated radiographs will often prevent mal-union or non-union which in turn lead to prolonged disability. In a very small number of fractures early operative repair may be indicated.

In discharging the workman after the functional cure of a fracture the nature of the work to be done should receive consideration. Men who are not required to exercise great muscular effort may often be allowed to return to work after a few weeks, if no particular strain is put upon the fractured bone. In other cases where a man is required to lift heavy weights or do other similar work, it is unwise for him to return to such work until union is firm. I have seen fractures of the humerus recur in men, otherwise apparently normal, more than six months after the original injury. After union is reasonably firm, functional use promotes strength and bone formation. In cases of this type it is often advisable for the injured employee to undertake some form of light work during the period of healing. In many cases it is difficult for the surgeon to persuade an employer to take on a man not entirely fit for work, and it is frequently difficult to make the employee see the necessity of light work in the process of recovery. However, if the surgeon will spend a little time in the education of both employer and employee, he will usually be able to make them both realize that employment, as soon as is compatible with the nature of the injury, will in the end work for the benefit of both the employee and the industry.

Injuries about the joints often lead to prolonged periods of idleness. According to recent reports on war surgery, joint injuries heal more rapidly when subjected to

* Mock: *Industrial Medicine and Surgery*, Philadelphia, W. B. Saunders Company, 1919, p. 585.

active movement from the start. Active mobilization of injured joints was the generally accepted form of treatment during the last year of the war. Favorable reports have followed the use of this plan of treatment in industrial surgery, but it is perhaps too early to state that it will result favorably in cases of all types. However, it is in line with the recognized treatment of sprained ankle, the treatment of which has undergone a radical change during comparatively recent years. Most surgeons can remember when sprained ankle meant disability for a period of from two to six weeks. Now the ankle is strapped and the man ordinarily returns to work within a few days.

Burns, if treated with ointments or wet dressings, are apt to lead to prolonged periods of disability. Recently the application of melted wax has been advocated as much superior to the older methods. If good results are to follow its use, the utmost care is required in its application. The granulating surface must be well dried and the dressing applied daily. In the experience of the writer, the open air treatment of burns, after the first few days, is much better than any other plan of treatment. The granulating areas may be constantly exposed to air or may be exposed only for a few hours during the day, being dressed at night with a boric acid or saline wet dressing. During the late stages the application of skin grafts will materially hasten the growth of epithelium.

Functional Re-education

After certain injuries there is a distinct loss of function, which is partially due to the injury and partially secondary to disuse. The muscles are atrophied, the circulation is poor, the joints and tendons are stiff, and the skin is pale and flabby. Such cases require functional re-education, associated with the application of moist or dry heat and well-controlled passive motion and massage. Excellent results have been obtained in war cripples by the use of these measures. It is to be emphasized that functional re-education is hardly in the province of the individual surgeon. The use of simple machines and apparatus, combined with massage, hot and cold baths, and baking, is best carried out in a clinic devoted exclusively to work of this type. The psychic effect upon the patient of receiving treatment together with other men suffering from similar disabilities is excellent. When treatment is begun, others are seen who are nearly ready for discharge and the patient learns at first hand of the excellent results obtained. He is consequently more ready to devote his time seriously to the necessarily long and tedious course of treatment. Such a clinic has been established in many of the army hospitals, and the Livingston Street Clinic for Functional Re-education in New York City is devoted exclusively to work of this sort, both for disabled soldiers and for industrial injuries. Such a clinic should be established in every industrial center. In a clinic of this sort expert surgical opinion should be available so that the disabled worker may receive full benefit from the best type of surgical treatment.

Vocational Re-education

Thousands of ex-soldiers and sailors are now being trained by the Federal Board for Vocational Education. Men who, as a result of injuries received in service, are permanently handicapped in their old occupations are being trained so that they may be able to overcome the physical handicap. Men who, because of the loss of an arm or leg, would probably have become government pensioners have been trained so that they are now able to command high wages as skilled workmen and are not only supporting themselves but their families as well. Federal legislation for the education of industrial cripples has recently been

enacted and a federal appropriation is available to each state which will make an equal appropriation for the work. Some idea of the extent of the work of the federal board may be gained when it is realized that during 1919 vocational schools received more than a million dollars from the federal government.*

The part the surgeon plays in this phase of rehabilitation is that of an expert advisor. Having in mind the particular disability, he should pass upon the advisability of returning a cripple to his old occupation and the practicability of the proposed course of training.

* Cummings, John: *Vocational Schools Federally Aided*, The Vocational Summary, Dec., 1919, **2**, 143.

Summary

1. The surgeon, in order to do his entire duty by the injured wage-earner, should consider not only the medical aspects of the patient but the economic aspects as well.

2. General production may be increased and economic loss decreased by the scientific application of modern surgical methods.

3. Every surgeon who is required to deal with the casualties of industry should be thoroughly informed upon the subject of vocational re-education and should, by his advice to employer and employee, encourage this humanitarian movement to salvage the industrial cripple.

THE MODERN SPECIALIST IN UNREST: A PLACE FOR THE PSYCHIATRIST IN INDUSTRY*

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INDUSTRIAL medicine exists; industrial psychiatry ought to exist. That industrial medicine exists is attested by the founding of national and local societies, journals, personnel groups, and by the pursuit of researches; industrial psychiatry, while it has logical claims to existence, has hardly taken shape. In a paper on "The Movement for a Mental Hygiene of Industry" appearing in *Mental Hygiene* for January, 1920, I have collected those few references which indicate the probable future course of industrial psychiatry, of industrial psychology and of the new field of psychiatric social work as applied to industry. In that communication on the general aspects of the new movement I tried to state the issues for non-medical readers, especially for those advanced engineers, employment managers, and other industrialists who see more in industry than either its "efficiency" aspect narrowly taken, or its "welfare" aspect narrowly taken. I would be pleased if I could, in the present communication, awaken the interest of psychiatrists themselves to what must be conceived as another immediate addition to the community functions of the psychiatrists. In some sense, then, the present communication is a foil to my earlier paper written for laymen on the movement in general.

I seize the opportunity afforded by the fortieth anniversary of the founding of the Boston Society of Psychiatry and Neurology for the present purpose, because that society is well representative of the two sides of psychiatry that have developed, rather independently, from the necessities of the state-care program for the insane on the one hand, and from the necessities of private psychiatric and neurological (including medico-legal) practice on the other. This society, made up as it is of both kinds of psychiatric practitioner, public and private, ought to be especially sound upon new matters like the development of industrial psychiatry, which touches public, social and individual interests alike. As my hearers are thoroughly aware, between the work of the public psychiatrists — whether busied with hospital administration and treatment or concerned with medico-legal decisions — and the work of private practitioners in neurology or psychiatry — men busied with the individual problems of diseases for the most part falling short of the asylum degree —there has come recently to fairly complete logical development the new field of social psychiatry, a field wherein the problems of the probate court and the problems of the consulting office are amplified, developed and pursued in a hundred ramifications in the social web. Many of our public practitioners of psychiatry, that is, the institution men of the commonwealth of Massachusetts, are already convinced of the value of psychiatric social work in this new intermediary field which lies between the fields of public practice and private practice in mental diseases as these fields have been construed up to recent times. The files of the Psychopathic Hospital will soon contain many thousand socially investigated cases, derived from Boston and the surrounding metropolitan district. But private practitioners in neurology and

* Address at the fortieth anniversary of the Boston Society of Psychiatry and Neurology, Jan. 15, 1920. Received for publication Feb. 28, 1920.

psychiatry are also becoming aware of the values of the psychiatric social worker for any private practitioner who takes his job seriously and seeks to solve his psychiatric problems with all modern aids.

The three fields of public, social, and individual practice in psychiatry are thus well logically in mind in Massachusetts, as indeed they are becoming clear to most other Atlantic seaboard states and to all urbanized communities that have faithfully undertaken the work of mental hygiene on approved lines. Yet some of us, I fear, may still regard this intermediary field of social psychiatry more as a theory than a condition. Luckily, the men who think practice more important than theory are fast dying out or undergoing belated conversion through reflection on the successes of theory in the Great War. If, however, you actually do meet one of these incorrigible practical men who will see nothing in theory, it is as a rule enough to show him the results of social psychiatric practice among the relatives of the victims of neurosyphilis — general paresis and the like — to convince him that mental hygiene has unlocked a brilliant and efficacious novelty for public health in its work upon the so-called "syphilis of the innocent." I make this point about social psychiatric practice somewhat at length, not so much for my present hearers as for others who may read the printed remarks and wonder whether after all there exists a personnel to attack such widely ramifying problems as those of industrial psychiatry. There does exist the appropriate personnel for work in industrial psychiatry. There is, to be sure, not enough such personnel; but there do exist competent workers who can be multiplied as soon as industrialists begin to crave this personnel and as soon as psychiatrists see the peculiar values of the new work.

Why do I speak of the mental hygiene of industry? Why should the medical man enter fields like those of psychology and social work, fields in which he is not competent by special training or by daily experience? We all know that there is a border-line between the work of psychiatrists and the work of psychologists, and that claims and counter-claims have been made by representatives of psychiatry and psychology. Why is it not better for psychiatrists to pursue their own expert ways, leaving psychologists to theirs? We are all aware that heated discussions have taken place in national associations anent, for example, the so-called "diagnosis of feeblemindedness," which seems a medical problem to the psychiatrists and an educational problem to the psychologists. It seems to me, however, that although heated discussions upon abstract lines may occur at society meetings, there is absolutely no practical or concrete difficulty in marking out the peculiar uses of the psychiatrists and the psychologists in particular, concrete cases of mental disease or defect. For example, at the Psychopathic Hospital the work of Professor R. M. Yerkes, psychologist to the hospital, ran with perfect smoothness alongside of the work of the psychiatrists in the hospital wards and the out-patient service. On these practical grounds, as well as on sound theoretical grounds, I conceive that it is both tactical and strategic to place psychiatric art and psychological science under the one head of "mental hygiene," a term which has medical suggestions, but which has also equally pronounced suggestions of normality and health. Where so many of our problems in the social division of psychiatric practice lie along this border-line between normal and abnormal, I conceive that the term mental hygiene is perhaps the best that can be found to describe the sudden enlargement of the psychiatric range in recent years. But, together with the psychiatrist and the psychologist, I would also range a psychia-

tric social worker as a third kind of mental hygienist. The mental hygiene of industry will of course require the services of all three types of mental hygienists, as I endeavored to make plain in my communication for laymen entitled " The Movement for a Mental Hygiene of Industry." As psychiatrists and physicians we shall not forget the importance to mental hygiene in general of mental hospital nurses, of occupation workers, and of specialized types of teachers for mental diseases and defects. But these latter varieties of mental hygienists are not so much in point in the primary field of industrial psychiatry. In that field a working party, composed of psychiatrist, psychologist, and psychiatric social worker should, if possible, have added thereto a person skilled in tabulation and statistics.

I have just employed the phrase *working party* in the mental hygiene of industry. Such a working party would be of value in almost all other fields of mental hygiene — for example, in the survey of a state or district, an occupation group, a racial group, or any other special group of persons whose mental hygiene demanded attention. Parenthetically, I am sure you will all agree that there is hardly any group of persons in the world that would not benefit from mental hygienic analyses made upon the triple lines herein indicated. Thus, such a working party, composed of psychiatrist, psychologist and social worker, can already be found in advanced juvenile courts, and even in certain courts for adult cases, and would undoubtedly be of the utmost service in all domestic relations courts. Again, in schools, in various institutions for the care of children, this combined insight would penetrate many a dark corner.

But industry seems to me to be the problem today nearest to the hands of mental hygiene. One is impressed with the readiness of industry for such working parties in mental hygiene. The war has brought industrial problems into sharp relief; reconstruction has altered the focus in places but has not abolished the problem. Above all, there is at the present day the so-called industrial unrest, a problem met apparently with not too great intelligence, if we can judge by the nullities and silent dispersal of certain national industrial conferences in our country. To be sure, the Royal Commission on Industrial Unrest in England during the war time (1917) did important service in laying down certain concrete findings and recommendations, but those results were war-time results confined to Great Britain. The psychiatrist who reads the Royal Commission reports can scarcely avoid being convinced that greater and more significant results could have been obtained if the principle of the mental hygiene working party could have been adopted in the British investigation.

A word or two is in place about the respective functions of the members of a mental hygiene working party. For the benefit of those who come to this problem for the first time, let me insist that such a working party is not proposed for the purpose of supplanting the employment or personnel manager or any other major or minor executive in the industrial plant. I hope to convey by the term working party the idea of an investigation, occasional rather than permanent, carried out by special officers having the weight of certain connections outside of the industrial plants themselves. Of course the psychological examiner will no doubt prove a relatively permanent portion of the organization of an industrial plant as soon as plant managers get clearly in mind the successes of psychology in the army in the classification of personnel and in the elimination of the unfit through group and individual mental tests. Probably this aspect of the propaganda for mental hygiene may be regarded as properly under way though, in my opinion, certain plants

have at least been adopting it more as an efficiency device than as a welfare or social adaptive measure. But the tendency to exploit the values of mental measurement for the mere elimination of the individual from a particular plant will be short-lived if we can somehow kindle the spirit of mental hygiene in the whole industrial problem. After all, the psychological examiner will find himself of greatest value in the employment or hiring side of the plant's work. As the years pass, the psychologist may also learn to contribute to the problem of promotion upon lines of vocational psychology. But for the present the psychological examiner, in the narrow sense of this term, will be of decidedly lesser value in the interpretation of the discharge-rate or turnover in industrial plants. The industrial plant should have the list of discharged employees gone over from time to time by a consultant psychiatrist or a neurologist interested in the psychiatric side of this work. Such consultant psychiatrist should be in complete touch with the psychological examiner and should have at his disposal such records of mental testings or other recorded impressions as the psychologist may have. He should likewise be able to secure and interpret the records of social work, especially those made in connection with discharged employees.

The psychiatric social worker, like the psychological examiner, will probably become a permanent element in the plant, although most of her work may well be done outside its walls in the community and especially in the families, even of those who become industrially disabled and of those who are discharged, when the reasons for their discharge are consistent with the spending of the plant's time and money on their families. Luckily, in advanced urban communities the standard of social welfare has been advanced at least to the point reached by the standards of efficiency inside the plants. The result is that by a minimum of exertion on the part of the social worker, proper transfers of these families of discharged workmen to other agencies can be arranged for. Where there are a number of industrial plants in a single community, the social workers connected with these plants would naturally be closely associated with one another in their social conferences and society meetings. Industrialists tell us that co-operation is more the order of the industrial day than competition. However this may be in industry as a whole, there can be no doubt that the social treatment of families of employees discharged from plant A will benefit the turnover sheet of plants B and C, etc. If plants B and C employ social workers of like skill, plant A will in turn benefit in its turnover sheet. In brief, the welfare of the discharged to a certain extent means the efficiency of the plant. The general problem of turnover is aided by the well-known principle of mutual "back-scratching." Meantime, the welfare values obtained for the community as a whole run beyond the superficial relief of the industrial skin.

How soon it will be possible to make physicians in general and medical social workers, not especially trained or expert in mental problems, see eye to eye with the psychiatrist and the psychiatric social worker in this matter of the mental hygiene of industry, is hard to say. However, from the operations of national and local societies of industrial medicine, it appears that physicians in general are becoming much alive to the virtue of this new combination of medicine and engineering. Psychiatry has made such strides in relation to the more superficial problems of social work that psychiatrists are often overwhelmed with the kind and degree of expectation uttered by social workers. The extreme range of such expectation is shown in the files of the out-patient department in the social service of the Psychopathic Hospital in Boston. Much is expected of the psy-

chiatrist in the new social division of his practice.

It is particularly in the grievances that come to the attention of the employment manager that the psychiatrist will find his work laid out. In the communication on the " Movement for a Mental Hygiene of Industry " above mentioned, I have quoted from Read a list of causes for removal from a certain large payroll. The following entries will readily suggest to the psychiatrist what sort of investigation ought to be carried out, especially with the aid of the psychiatric social worker:

Certain Causes of Removal from Payroll

Did not like supervision.
Refused to be transferred.
Resented criticisms.
Did not like working conditions.
Work too hard.
Agitator.
Carelessness.
Dishonesty.
Drinking.
Fighting.
Indifference.
Insubordination.
Too slow.

There is also a paragraph called " superintendent's private file " among the " unsatisfactory " groups of removals that might well be looked into by the consulting psychiatrist. Where do all these grudge-bearers, agitators, drinkers, fighters, and lazy persons go ? Some of them figure within a comparatively short time in the discharge files and turnover analyses of nearby plants. We may talk of the solution of such problems as a duty of the community, but it should not be long before industrial plants themselves recognize the efficiency and welfare virtues of attending as strictly to their human outgo as to their human intake. I mentioned the work of the British Royal Commission on Industrial Unrest in 1917. I present a summary of their findings made by the Right Honorable G. N. Barnes, M.P., not because all of the fourteen items are particularly related to our own or to any special problem in industrial hygiene but to show the general nature of the Royal Commission's work.

Summary of the Industrial Unrest Findings in England, 1917, by G. N. Barnes, M.P.

1. High food prices in relation to wages, and unequal distribution of food.

2. Restriction of personal freedom and, in particular, the effects of the munitions of war acts. Workmen have been tied up to particular factories and have been unable to obtain wages in relation to their skill. In many cases the skilled man's wage is less than the wage of the unskilled. Too much centralization in London is reported.

3. Lack of confidence in the government. This is due to the surrender of trade-union customs and the feeling that promises, as regards their restoration, will not be kept. It has been emphasized by the omission to record changes of working conditions under schedule LL, article 7, of the munitions of war act.

4. Delay in the settlement of disputes. In some instances ten weeks have elapsed without a settlement, and after a strike has taken place the matter has been put right within a few days.

5. Operation of the military service acts.

6. Lack of housing in certain areas.

7. Restrictions on liquor — this is marked in some areas.

8. Industrial fatigue.

9. Lack of proper organization among the unions.

10. Lack of commercial sense — this is noticeable in South Wales, where there has been a breakaway from faith in Parliamentary representation.

11. Inconsiderate treatment of women, whose wages are sometimes as low as £13.

12. Delay in granting promises to soldiers, especially those in class " W " reserve.

13. Raising of the limit of income tax exemption.

14. The workmen's compensation act: the maximum of £1 weekly is now inadequate.

Among the recommendations of the British commissioners are to be found recommendations concerning:

1. Food prices (of which the commission stated there should be an immediate reduction with an increase price partly borne by the government and with a better system of distribution).

2. Industrial counsels on the principles of the Whitley report.

3. Authoritative statements by the government as to further increase of output (wartime conditions).

4. Participation by labor in the affairs of the community as partners rather than as servants.

5. Publicity in certain matters relative to leaving employment.

6. Publicity by the government concerning its pledges already given.

7. Raising of the £1 maximum under the workmen's compensation act.

8. Announcement of the policy as regards housing.

9. Skilled supervisors to receive bonus.

10. Closer contact to exist between employer and employee.

11. Pensions committee to be granted more discretion. Treatment of men discharged from the army.

12. Certain agriculturists' wages to be raised.

13. Colored labor not to be employed in ports.

14. A higher taxation of wealth (by one commissioner).

According to the commission's report, there were the following four universal causes for unrest in England: (1) food prices and distribution of supplies; (2) restriction of personal freedom; (3) card system for military and industrial service; (4) inco-ordination of government papers. Certain acute though not universal causes of unrest were: housing, drinking, and fatigue. The commission also speaks of " psychological " conditions and remarks that " the great majority of the causes of industrial unrest specified in the (8 district) reports have their root in certain psychological conditions." Among these may be mentioned: lack of confidence in the government, feeling of inequality of sacrifice in army and industry, the idea that solemn pledges were broken and turned into " scraps of paper," feeling of unreliability of certain trade-union officials, and feeling of the uncertainty of the whole industrial future.

The commission was no doubt justified in laying enormous emphasis on what it calls " psychological " conditions. The psychiatrists and the medical men in general must feel that the blanket term psychological condition covers a good many psychiatric difficulties. Thus, whoever follows the strong trend to individualization in medicine, psychiatry, in education — both intellectual and moral — and even into the law courts, must be convinced that individualization should proceed to greater lengths in industry. There is nothing more wide-spread in modern sociology than certain ideas about group action as the " be all " and " end all " of progress and failure in social developments. As one author puts it, group experience leads to group thought, group thought to group action. If we take, for example, the universal causes of unrest summarized by Barnes of England, we shall of course be convinced that food prices might well be a group experience, a poor distribution of supplies might be to a large extent a group experience. There would also be a group experience of the evils of card systems which might lead to group thought, and unrest of mind might create tendencies to strikes; distribution of supplies would tend to follow group experience and thought as in the case of prices and service cards. When it comes, however, to a question of the restriction of personal freedom and to a question of government inco-ordination, it must be observed that these are hardly group experiences as much as individual experiences. The workman who objects to being passed automatically from one sphere of labor to another may make himself heard effectively in group thought; the victim of some inco-ordination on the part of government departments may do the same. But it certainly must be true that the effects of such restriction of freedom and of temperamental inco-ordination are, as a rule, individual. The voices of the victims, however, are raised along with the voices of general unrest concerning food prices and the service card system.

We cannot help thinking that the principles of social work and especially psychiatric social work, applied to the problems of

the restriction of personal freedom or of temperamental inco-ordination, will solve most of the problems. The matter of automatic transfer from certain spheres of labor is of course a war rather than a peace matter, but the item will serve as well as another to indicate that universal causes of unrest need not be the product of group experience, need not have led to group thought, and need not lead to group action unless in the presence of other more general causes of unrest. Many of these problems, possibly the majority of them, are extraordinary rather than main problems. The same holds for the " acute " as contrasted with the " universal " causes of unrest, most of which acute causes are described by the commissioners as arising locally from different problems, such as family housing, drinking, fatigue, or even such a problem as that of lack of confidence in the government, specified among the findings as lack of commercial sense (No. 10). We find from the commission's report that this lack of commercial sense was especially noticeable in South Wales where there had been a break-away in faith in parliamentary representation. I do not know any single important fact relative to South Wales and its break-away from the democratic faith, but certainly there must have been a local condition which no doubt had local causes, some of which are almost certain to have been due to the operations of a particular man or group of men.

This introduces us to the most general aspect of the unrest problem, the aspect which leads me to give to my paper the somewhat cryptic title of " The Modern Specialist in Unrest." It may be — or, as I suspect, it may not be — that group experience leads to group thought and group thought to group action as the ordinary course of events in social developments. But whether these developments are group matters or not, it remains true that most of the information which we possess concerning group psychology and group psychopathy is derived from the psychology or the psychopathy of the individual. If this statement be accounted true, then I do not need to insist that the psychiatrist is rather more likely than any other expert to know how the main lines of unrest will run. Unrest on the part of the individual is the big problem of the psychiatrist; year in and year out he comes in contact with the finest, as it were, and the most brilliant examples of unrest in the shape of particular patients in his wards. If this general account of things be correct, the psychiatrist ought to have a message for industry. Psychiatric knowledge about the unrest of the individual ought to be turned to account in our analyses of group unrest.

The main thesis of the present communication is that a psychiatrist has a place in industry. I think that he will have a place in the routine of industrial management, not as a permanent staff member (save in the instances of very large firms and business systems) but as a consultant, at stated periods, relative to the matter of grievances, complaints and dissatisfactions, actual and potential. The function of this occasional consultant would be preventive rather than curative of the general conditions of unrest. How far we can think of the industrial psychiatrist not merely as a preventive agency, but as a curative agency for conditions of unrest, the future must decide.

What is unrest ? The theory that group experience leads to group thought, which in turn leads to group action, may be sound theory for a portion of industrial phenomena, but individual experience, individual thought, and even individual action are also factors in industrial situations. How far is unrest a matter of group or crowd or mass psychology ? How far does mass psychology depend upon the psychology of the individual member ? It will not be wise to generalize to the effect

either that industrial unrest is entirely a group phenomenon or that it takes its rise entirely in the minds or in the hearts of individuals. We have seen that some of the causes of unrest in England might well be matters of group psychology, but that other causes of unrest seem almost in their nature to have been of individual origin.

That portion of the unrest problem which depends not upon group experience but upon individual experience, not upon group thought but upon individual thought, and finally not upon group action but upon individual action, is the proper topic for the psychiatrist. The psychiatrist, particularly in company with the psychiatric social worker, has always been a specialist in unrest — unrest, to be sure, confined within asylum walls. The modern psychiatrist has under more or less definite supervision large numbers of the so-called psychopathic personalities — persons who are not insane in a kind or degree to warrant their commitment to institutions, but who are psychopathic enough or in such wise as to benefit from community supervision. It is this modern contact with the psychopathic personalities, with instances of so-called psychopathic inferiority, with psychopathic states, that makes the modern psychiatrist a specialist in a kind of unrest that interests the community very deeply. These psychopathic personalities have been recognized even in the immigration laws and in the official tabulations of the Army and Navy under the terms "constitutional psychopathic inferiority," "constitutional psychopathic state," and similar designations.

It is important for the modern psychiatrist not to "hide his light under a bushel"; he must step forth to new community duties. It is on this account that I conceive that a recent step of the Engineering Foundation, representing the United Engineering Society, is of so much importance. Among the earliest problems undertaken by the Engineering Foundation is the problem of the mental hygiene of industry. To the writer, as the Director of the Massachusetts State Psychiatric Institute, was entrusted a research of definite dimensions, relative to the mental hygiene of industry and the problem of mental abnormalities in relation to industrial personnel. The enlightened officers of the Engineering Foundation immediately found the ramifications in the research of mental hygiene of industry so numerous and so broad that a plan is being mooted for investigation of the entire problem of industrial personnel. On the suggestion of the Engineering Foundation, the National Research Council appointed a committee, composed of representatives of its divisions of anthropology and psychology, educational relations, engineering, industrial relations and medicine, to consider the scope of investigation into industrial personnel.

It seems to me that as psychiatrists we should help this movement wherever it becomes practically possible. The practical possibilities of helping lie in connection with the fact that the majority of our male patients have either come out of industry or are going back into industry in some capacity. Special investigations of the individual patients with respect to their industrial status and future should be made. The information which the psychiatrist possesses concerning personality, temperament, and special abilities, as modified by mild mental disease and defects, should be at the call of the employment manager. There should be a drawing together of the psychiatric and industrial interests of all communities. The psychiatric social workers of the state institutions should meet similar workers from the industrial plants to discuss the individual fates of particular discharged workmen. Psychopathic persons can be fitted into industry far more successfully than most psychiatrists and

industrialists are feign to believe. The employment work at the Psychopathic Hospital during the last four years has definitely shown these adaptations of the psychopathic employees to be both numerous and effective.

I do not need to rehearse to this audience the early conclusions of Dr. Adler concerning unemployable personalities, based upon Psychopathic Hospital studies, more than to recall the immediate sub-divisions which he made into the problems of fitting into industry (a) the feebleminded, (b) the cyclothymics, and (c) the paranoiacs. Every employment manager is aware of the existence of the feebleminded and of their availability for certain kinds of work. Industrialists are also quick to recognize the cyclothymic with their ups and downs of emotional mood as actual inhabitants of mills and mines, and much can quickly be taught the employment manager concerning the special virtues and faults of these victims of the cyclothymic constitution, and even of the more severe forms of manic-depressive psychosis. The paranoiac patient is ready to be recognized by the employment manager as a man with a grudge or chip on his shoulder. In fact, the task of letting in a little psychiatric light upon these problems is not so difficult as might be conceived; the success of Psychopathic Hospital clinics for employment managers in the summer of 1919 attests the value of spreading these practical doctrines of mental hygiene among industrialists.

SOCIAL WORK AND INDUSTRIAL HYGIENE

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IN more primitive times the king's barber was also his doctor. But the demands for the two kinds of attention soon increased to the point where one man could not master both arts. So, certain men devoted their whole lives to healing and all that goes with it. Then the kindly friend who was called doctor did all that is done today by doctors, druggists, dentists, nurses, and social workers. But in accepting these colleagues, the modern doctor has relinquished, at times reluctantly, certain of his prerogatives. "He makes his own instruments," is no longer spoken in praise of a surgeon. And the doctor who does his own social work is usually he "who rails at progress with a narrow mind, and marvels much that he falls behind."

Fortunately social work is now universally accepted as a necessary adjunct to medicine, and medicine has become indispensable to industry. How far has social work followed medicine in this field? Not far, I fear. But, if social work is indispensable to medicine, is it not essential in industrial medicine? It is; in no field of medical practice is the social worker more needed than in industry. This man has an injury and is to be cared for at home. What is the character of that home and what are the chances of his life there being conducive to recovery? The visit of the social worker not only answers this question but carries the advice necessary for making home care possible. The next man shows a falling off in his work, he is irritable and difficult to deal with. His health seems good so far as physical examination can reveal but the social worker finds harassing conditions at home which readily explain his irritability — difficulties which she can perhaps remedy. A patient cannot be treated with disregard of his family; in fact, the family itself must be treated.

The social worker thus becomes an aid in the problem of industrial relations. In fact, to try to outline the place of social service in industry would be but to review its place in medicine. But in industry there is still another aspect of social work which offers opportunity. The social worker not only has an important relation between doctor, patient, and home, but an equally needed place between doctor, patient, and employer. I have frequently seen an injured employee advised to return to work but to confine his efforts to some "light job." Who arranges this matter? Usually no one, for such patients are often turned over to a foreman with inadequate care or consideration. He either does nothing or too much, and so fails. The doctor cannot do his work well and attend to either home or factory adjustments. Expecting untrained families or foremen to make these adjustments means failure.

Lastly the field of research must be considered. No man of worth in any walk of life is content to labor on routine without opportunity to conduct investigations as problems arise, and medical research investigators in industry can utilize the social worker to great advantage.

I cannot close this brief statement without some reference to the psychiatric social worker. Already a literature is being created on the mental hygiene of industry. Every company has a certain percentage of employees who are nervously or mentally handicapped. They are especially in need

of social service supervision. Again those important factors in life which come within the range of personality need attention, and here the social worker must be ambivalent, serving both doctor and employment manager. The demand for psychiatric social workers who have received special preparation, such as the Smith College Training School for Social Work and the New York School of Social Work offer, is very much greater at the present time than the supply, but occasionally one with special interest in industrial problems may be secured for work in a plant.

THE SUCCESSFUL INDUSTRIAL MEDICAL DEPARTMENT*

Essential Co-operation of Executives and Employees Gained by Proper Methods

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THE establishment of a medical department in an industrial or other employing organization is usually considered with caution and, not infrequently, with trepidation. The details of location, physical equipment, and general organization offer no problems that cannot be handled readily as are similar details in ordinary business or plant developments. But, unlike most other departmental projects, the establishment of the medical department is concerned largely — in rather intimate and personal relation — with the human element in the group, and more especially in the individual. This factor is doubtless one of the most vital ones in the success or failure of the new organization.

The establishment of a medical department, therefore, calls for the utmost tact, judgment, and discretion. From the very first open frankness must prevail and this keynote, properly struck, can and must be maintained to "sell" the medical department to those concerned — executives and employees alike. It must be recognized that this new venture, especially where it is altogether new, must be "sold"; it must be accepted freely and fully for a precious price. That price — complete co-operation and friendliness — must and will be paid freely under proper methods and due tactfulness. This factor is emphasized so strongly here because the experience and observation of the writer, as well as of others, prove its importance. Experience on this point in the establishment of a medical department in a large Philadelphia industrial plant affords a concrete practical example.

The "family spirit" among the employees of the plant in question is rather highly developed. This is especially true of the nearly 200 women employees in the general offices. Certain of the women department heads have had long service in the company, and have traditionally been leaders among the women and girls. The same condition applies in a smaller measure to the men employed, many of whom have been with the firm a long time. The value of the immediate co-operation of all such employees is apparent, but to favor any group by a special or prior approach would immediately cause resentment. The problem with the women and girl employees is especially delicate in this particular. In establishing the medical department every feature as to possible effect on the attitude of the women employees, as to the effect on labor, and on labor organizations represented among the men, as to the effect of rulings by the medical officer on new and old employees, detailed method of organization of the force to aid the medical officer, first-aid instruction, physical equipment, necessary forms and procedure in examination, and other details were considered.

Fully equipped offices for the department were provided from the start. This is important not only from a practical working standpoint, but also from the effect of thoroughness produced at first contact. In selecting a location for the offices of the

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medical department, advantage was taken of the fact that high-grade lavatories, shower baths and locker rooms had been previously installed both for men and for women. The medical department was placed adjacent to them, thus making it unnecessary to provide special facilities.

A brief reference to the equipment provided is of interest. Incidentally, as a matter of tact, the equipment in the various shops, etc., was not installed until after the entire project had been explained to the employees. The waiting room, examining room, and emergency operating room are all fully equipped with standard fittings and apparatus. The rooms are well lighted and ventilated, and present a cheerful aspect. This element is a worth-while consideration both from the standpoint of practical usefulness and because of the general good mental effect. First-aid cabinets are distributed throughout the plant. Stretcher-cots are strapped to the walls at convenient points. This equipment is in charge of a foreman or other person in each department who is responsible for its current upkeep and efficiency. These persons are the only ones authorized to apply the emergency first aid, or to use the equipment and supplies ordinarily. They are specially qualified by reason of regular instruction under the direction of the medical officer — a point which will be considered in further detail later.

The opening of the medical department was considered of such importance that the president and general manager made this his personal business. The employees were gathered informally in the general offices and the president explained in a simple, friendly manner, the new organization. He emphasized particularly the fundamental aims and purposes, classing the work of the medical department as a purely business arrangement, of mutual benefit to the employees and to the company, and in no sense a charitable or paternalistic venture. He outlined the absolute need for thorough co-operation and discussed briefly also the few rules and regulations pertaining to the new department. No person at present employed with the company, for example, need take the medical examination; all new employees must do so, as must employees desiring promotion.

The medical officer was then introduced, and after a few words of greeting, he outlined the organization, and then proceeded to become personally acquainted with his newly acquired patients. This suggests also that the personality and professional standing of the industrial plant physician is of vital importance. In this instance, as the president told his employees, and with marked effect, their new medical adviser was his personal physician, and had been for twenty years.

As has been stated, co-operation is essential to the success of this medical work. When initial confidence had been established, and the danger of antagonism obviated, the next step was the shaping of a working organization. In each department or shop, foremen, forewomen, and others in executive charge were appointed as assistants to the medical officer. The first-aid equipment and supplies were placed in their charge. Two persons in each department were given a series of lessons in first-aid treatment. Actual demonstrations were made in the various shops and offices. This feature is especially valuable, in that the morale is unaffected when real accidents happen. Numerous kinds of accidents have been encountered in the year that the department has been in operation, and in each instance there has been perfect co-operation and conduct. This is in striking contrast to former conditions, as is admitted by the company's executives, when even a minor accident always caused widespread commotion, disorganization, and loss of much time.

This spirit of co-operation has developed

as the medical department by conscientious service has established itself more firmly. Many of the executives of the company consult the medical department on matters of personal health. Timely precautions frequently save the loss of days of an executive's time, with a corresponding uniform efficiency in the department under his or her charge. Similarly, prompt attention to the illness of employees wards off more serious illness and consequent loss of time.

The medical department is called upon for various kinds of service other than in purely professional matters. For example, ventilation standards have been specified to suit the peculiar requirements of the various shops and offices. Fans have been recommended and installed where needed, ventilators prescribed to overcome objectionable drafts, thermometers installed to insure more even temperature, and lighting facilities improved. In fact, a live medical department is always on the alert for any improvement that will benefit the employee, making him a healthier, happier, and more satisfied worker. In achieving this end, the cost of the department is justified, not only as a commendable social endeavor, but as a mutually profitable business relation.

In conclusion, the successful medical department in the industrial plant must have adequate, modern facilities; it must be organized thoroughly to meet every emergency with calmness and efficiency; it must stand on its merits like every other department of a going business; but more than all these, it must have human personality and the spirit that inspires confidence in the human element with which it deals. Having these, the medical department gains and holds the co-operation that means success.

INDUSTRIAL DISEASES UNDER THE WORKMEN'S COMPENSATION ACT*

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IN the last lecture I dealt with the results obtained from notification of certain industrial diseases. Today, I deal with the results of scheduling them and others under Section 8 of the Workmen's Compensation Act of 1906. In the other lecture I laid stress on the fact that samples of the six diseases which medical practitioners are called upon to report are sufficient for statutory notification and as a clue to conditions over which the Factory Department desires to exercise control. The objects of the Workmen's Compensation Act and of the Factory Act, however, are not the same. The Compensation Act is much wider as it is intended to cover all cases of sickness of strictly occupational origin. The individual is here concerned, and not merely the conditions under which he works. Any description of disease, therefore, for which compensation can be claimed must be worded very widely, so as to sweep into the net all cases and not merely those with marked symptoms. Hence it is that in the description of the diseases scheduled for compensation the broadest designation possible is given, including the sequelae, and a wide description is given of the process in which it is presumed that the worker was engaged, who has contracted the malady.

The principle of the Workmen's Compensation Act was first extended to industrial diseases in the act of 1906 and there are now twenty-seven diseases to which it applies. A glance at the table of the diseases, either as it existed originally in the third schedule or after the addition of certain diseases by Order of the Secretary of State, reveals the absence of certain forms of poisoning and well-recognized trade diseases which might have been expected to find a place. Thus, poisoning by sulphuretted hydrogen gas, carbonic oxide gas, brassfounders' ague and fibroid phthisis, to mention four only, are not named.

* Cutter Lecture in Preventive Medicine and Hygiene delivered at the Harvard Medical School, Boston, Mass., Dec. 9, 1919. Received for publication Dec. 11, 1919.

Tests Applied to Each Disease

For the reasons which dictated the omission of certain diseases we must look to the tests applied to each disease by the committee on compensation for industrial diseases before the disease in question was held to come within the scope of the provisions and intentions of the act. They were:

1. Is it outside the category of accidents and diseases already covered by the act ?
2. Does it incapacitate for more than a week ?
3. Is it so specific to the employment that causation by the employment can be established in individual cases ?

Now, poisoning by sulphuretted hydrogen gas is invariably sudden, and therefore in the nature of an accident, and after-effects can be referred back to the definite time when inhalation occurred. Hence, such sudden poisoning is already covered by the act and only poisoning which is slow and insidious in onset and which might not easily be referred back is not covered. Poisoning of this slow type may result from nitrous fumes, carbon bisulphide, or from chronic benzol poisoning. Poisoning by carbonic oxide does not find a place because no convincing evidence was presented to the committee that it should

be treated otherwise than as an accident. There would have been danger in scheduling the sequelae of carbonic oxide poisoning, such as loss of memory and dementia, seeing how widespread is the use of gas in industry, and how easily subjective symptoms from it might be alleged with a view to a claim for compensation.

In the very rare instances in which hernia can be ascribed to a sudden strain, it would come within the definition of an accident. The committee, on the evidence heard, could not regard hernia as an industrial disease nor as an injury, not being an accident due to employment.

The second test excludes a malady of the nature of brassfounders' ague, as the attack is transitory and does not last for the period of a week.

The third test would exclude bronchitis and phthisis, but not fibroid phthisis, which the committee regarded as a specific and sufficiently distinguishable trade disease. I will explain how compensation has recently been extended to it. Fibroid phthisis was originally excluded because in no other of the diseases considered is there so long a preliminary period during which there are equivocal symptoms — cough and the like — which may, or may not, become graver and ultimately declare themselves as the disease for which compensation is payable. Every case of cough in a stone-mason, for example, might arouse suspicion that it was a symptom of the incurable disease, involving payment of a large sum in compensation, and unemployment among persons so suffering would, it was feared, inevitably result.

With the exception, therefore, of fibroid phthisis, the intention of the government was to schedule every strictly industrial disease which complied with the principles of selection and had been brought to their notice. This explains inclusion of some extremely rare diseases, such as nickel carbonyl poisoning for which, indeed, compensation has never been paid, the exclusion of the diseases named above and of the group of ordinary infectious illnesses — measles, scarlet fever and the like — when contracted by the worker through chance exposure to infection.

From time to time other diseases have been brought to the notice of the government with a view to scheduling them. Glassworkers' cataract, for example, has been scheduled under the condition that compensation should be made payable for not more than six months in all, and for not more than four months unless the sufferer has undergone an operation for cataract; and writers' cramp with the condition that compensation should not be granted for more than twelve months. Duypuytren's contraction of the hand was not considered by the committee to be proved to be due to industrial employment.

In the first year, 1,897 certificates of disablement were granted. Their number has increased year by year since, and the number in 1914 — the last year for which the statistics are published — was 5,642. Of these, miners' diseases (nystagmus, beat knee, beat hand, beat elbow and sprained wrist) account for not less than 4,957; lead poisoning for 469; eczema and chrome eczema for 88, leaving only 128 to be distributed among the remaining 19 diseases. Returns were collected from seven great groups of industries, i. e., mines, quarries, railways, factories, constructional works and shipping in which the aggregate number of persons employed was more than seven and a half millions. The total amount of compensation paid in 1913 was nearly £3,500,000, of which over £130,000 was for occupational disease. Over 90 per cent. of these claims were by miners; 6.9 per cent. were cases of lead poisoning. The annual charge for compensation per person employed was lowest in factories, being only 5/- per person; in the case of railways it was 8/5; in quarries 10/3; 13/3 in con-

structional work; and in mines 24/3. The total charge, including cost of management, legal and medical expenses, cannot have been less than £5,000,000.

Consider for a moment the amount of invalidity represented by the figures for lead poisoning alone. Plumbism is a chronic malady involving disability in the acute cases for four weeks — seldom less — and in the severe chronic cases for months. Taking an average absence from work of two months per case, the figures for 1914 alone represent ninety years of lost time, to say nothing of the disorganization of home life brought about by the illness. In 1914, in the seven groups of industries compensation was paid in forty-three fatal cases to the amount of £7,099 and in 9,622 disablement cases to the amount of £182,551. The number of "continued cases" was 3,598, or 37 per cent. of the total number (in the case of accidents the proportion was only 8.8 per cent.) and they accounted for £105,742, or nearly $7\frac{1}{2}$ per cent. of the disablement compensation.

From time to time, as experience has shown it advisable, the description of the scheduled diseases has been slightly altered. In general, this has always been in the direction of widening the scope so as to enable the workman to obtain compensation more easily. The first committee which drew up the list of scheduled diseases was inclined, not wishing to take a leap in the dark, to make compensation not too easy. Thus eczema was scheduled as "eczematous ulceration," intending by that to mean that trivial dermatitis was not to be considered. Later experience showed that dermatitis was hardly distinguishable from eczematous ulceration or at any rate was as much deserving of compensation as the graver condition, and now the description of the diseases has been altered to "(*a*) dermatitis and (*b*) ulceration of the skin produced by dust and liquids." Similarly poisoning by nitro- and amido-derivatives of benzene was not wide enough to include T.N.T. and it was necessary to alter the schedule to read "nitro- and amido-derivatives of benzene and its homologues."

TABLE 1. — CASES OF INDUSTRIAL DISEASE IN ENGLAND FOR WHICH COMPENSATION WAS PAID DURING THE YEARS, 1908–14, INCLUSIVE *

Disease		1908	1909	1910	1911	1912	1913	1914
Anthrax	A	4	2	6	2	4	1	4
	B	23	22	35	30	43	44	36
Lead	A	61	146	152	148	192	198	200
	B	421	351	367	406	414	371	344
Mercury	A	..	..	2	1	3	4	3
	B	3	1	2	5	6	17	6
Arsenic	A	..	2	..	..	1	..	..
	B	15	4	10	1	10	6	..
Ankylostomiasis	A	..	..	..	..	..	..	..
	B	6	8	7	6	4	2	4
Benzene Derivatives	A	..	1	5	..	2	4	1
	B	10	8	28	45	30	13	19
Nitrous Fumes	A	..	..	..	..	1	..	..
	B	..	..	1	6	4	8	3
Chrome Ulceration	A	1	..	10	2	4	4	3
	B	20	23	20	22	48	45	28
Eczematous Ulceration	A	1	5	4	6	9	5	4
	B	19	42	30	46	32	38	46
Cancer	A	2	..	..	3	2	3	3
	B	6	9	6	6	12	15	19
Nystagmus	A	74	380	662	1144	1819	2149	3218
	B	386	631	956	1375	1376	2402	2775
Beat Hand	A	28	20	32	38	46	42	60
	B	464	573	774	733	1078	844	817
Beat Knee	A	29	29	33	56	67	64	88
	B	539	881	1136	1402	1259	1630	1609
Beat Elbow	A	8	6	2	6	10	2	7
	B	67	63	80	130	114	136	165
Synovitis	A	..	5	10	4	5	10	10
	B	87	128	95	138	169	197	181

* Column A contains the cases carried over from the previous year; Column B, the new cases. Only those scheduled diseases are included in this table in which an appreciable number of cases occurred. For the full list of diseases see the Secretary of State's Statutory Rules and Orders, 1918, No. 287.

Procedure in Cases of Disease

Procedure under Section 8 of the act, when a disease due to the nature of the em-

ployment is in question, is very different from that in the case of an ordinary accident. As you know in the case of an accident, the claim is made directly on the employer and about 99 per cent. of such cases are settled without reference to the court. If there is any dispute, the case goes straight to court except when an application is made by *both* parties; then, the case is referred to a medical referee — a rare eventuality.

Except in the case of death, which must be proved to have been "caused by" the disease, the starting point of a claim for compensation under the industrial diseases section is a certificate obtained on application by the workman from the certifying factory surgeon of the district in which he is employed. The reason why a certificate is required is because the question whether or not the affected person is suffering from a particular disease is purely a medical one. The certifying factory surgeon was selected, no doubt, because, called on as he is to report to the Home Office on certain forms of scheduled industrial diseases and poisoning, he may be expected to have acquired a certain amount of expert knowledge. His name appears on the abstract of the Factory Act posted up in every factory and workshop. The surgeon certifies to the disablement of the workman, or, if not satisfied, certifies that he refuses thus to certify.

Illustrative Case. — The varying procedure permitted by the act, according to the attendant circumstances of the case, will be most usefully illustrated, perhaps, by taking a concrete instance. A house plumber, let us say, presents himself to the certifying surgeon, pays his fee of 5/-, is examined, and found to be disabled by lead poisoning from earning full wages. The certificate issued will state this, and there the duty of the certifying surgeon ends. It does not fall to him to say how long he thinks disablement will last. When this certificate, or a copy of it, is presented to the employer who last employed the disabled workman within the preceding twelve months, compensation (if the disease is attributable to the nature of any employment in which the workman was engaged within the last twelve months) falls due from the date entered on the certificate as the date of the commencement of the disablement, unless it can be proved that at the time of entering the employment the workman wilfully and falsely represented himself in writing as not having previously suffered. Provision in the section is also made for issue of a supplementary certificate in a case in which, as might conceivably be possible, the certifying surgeon was satisfied that the undoubted lead poisoning from which the plumber was suffering was contracted, in his opinion, from other sources as, for example, drinking water. And again, where the attack of plumbism developed within a few weeks or months of employment under a new master, seeing that like conditions of exposure existed in employment under other masters during the preceding twelve months, the other employers also can be made to contribute their share of the amount of compensation recoverable from the last employer.

Appeal to Medical Referee

Suppose, however, that the certifying surgeon is unable to satisfy himself that the plumber is suffering from lead poisoning so as to be disabled from earning full wages and gives the certificate to this effect, and that the workman, having been treated for this malady and having other medical evidence that he is so suffering, desires to carry the point further. In such a case the act provides for appeal to be made by the workman within seven days after the refusal, through the registrar of the county court. The medical referee or surgeon, to whom the case is thus referred, would be

one of those appointed by the Secretary of State under the act. Among these appointees are some appointed for a particular disease, for example, as is the case for lead poisoning in the potteries district. The decision of the medical referee is final; but before giving it due notice must be sent by him to employer and workman of the date when the examination of the affected person is to be made, and he must consider any statements made or submitted to him by either party. Equally with the workman, the employer has the right of appeal to a medical referee, and, *mutatis mutandis*, precisely the same procedure might follow after the granting of the certificate, had the employer strong medical evidence that the workman was not suffering from plumbism.

Where Burden of Proof Lies

Where the lead poisoning is contracted by a person handling lead, as must necessarily be the case with a plumber, the act provides that it shall be presumed that the poisoning was due to the employment unless the employer can prove to the contrary. If, on the other hand, a miner were to urge a claim that he had contracted lead poisoning in the course of his employment, the burden of proof would rest on him.

Claims in Fatal Cases

Claims in the case of death, in default of agreement, must be settled by the county court judge, who may have the medical referee sitting with him as the assessor. Then arises occasion for forensic skill in argument as to whether the term "sequelae" in, for example, lead poisoning includes such associated conditions as chronic interstitial nephritis, and cerebral hemorrhage, or even phthisis, a disease of bacterial origin, to which the plumber has become more susceptible by reason of lowered vitality, the result of lead poisoning.

Sequela means the result or consequence, and its significance is such that, to quote a writer on the law of this subject, "If the applicant relies upon the sequelae of a scheduled disease as the immediate cause of death or injury, he must show that that sequela was in fact caused by the particular disease, and not merely that it was a possible sequela, or one common to that and other diseases; in other words, that the scheduled disease was the ultimate cause of death or injury. The court will not infer that a complaint which may be the sequela of more than one disease is, in the case before them, the sequela of a scheduled disease."

Personally, I hold that Bright's disease is in this manner clearly associated with lead poisoning. The mortality figure being 160 for lead workers as compared with thirty-five in other occupations (all males), it would be useless to endeavor to prove that any person suffering from Bright's disease, who has worked in lead for more than ten years, would have contracted it independently of lead. And naturally, if chronic Bright's disease is admitted, the train of symptoms associated with it — notably arterio-scelerotic changes, resulting in cerebral hemorrhage and albuminuric retinitis — must be admitted also. I should not consider that pneumonia or any acute disease of the heart or lungs, or valvular disease of the heart, or indeed any acute febrile condition can have direct relation with — i.e., can be a sequela of — lead poisoning.

Although we have thus followed the procedure of Section 8 in its application to one disease only — that which, by reason of the difficulty in diagnosis, is most frequently the subject of dispute — yet substitution in the text of lead poisoning by any other of the diseases (except eczematous ulceration, where burden of proof is entirely on the workman) would make no difference.

I have said that the committee on com-

pensation for industrial diseases was unable to recommend the scheduling of fibroid phthisis, which was the more unfortunate as they regarded it as a specific and distinguishable trade disease. A certain amount of relief was brought to the sufferer in the late stage of the disease when he was able to claim sickness insurance benefit under the National Health Insurance Act which came into force in 1912. The National Health Insurance Act, however, only deals with sickness, whereas the Workmen's Compensation Act takes into account death also, and the dependents of the person who has died from an industrial disease are able to claim a reasonable sum equal to the earnings of the diseased man during the three years preceding the injury, or the sum of £150, whichever is the larger, but not exceeding in any case £300. Pressure, therefore, continued to be made to bring fibroid phthisis under the Workmen's Compensation Act.

Since the English committee on compensation for industrial diseases reported in 1907, much has been done in South Africa on this subject. Before 1912 more than one committee of inquiry had sat in South Africa and had reported against dealing with the disease on the principle of the liability of the employer on which the English act is based. The South African commission reporting in 1912 concluded that the difficulties in the way of providing for compensation in South Africa were not as great as in the United Kingdom. In the first place, the disease, fibroid phthisis, develops much more quickly in South Africa, the time taken being from two to five years, and not from ten to fifteen as with us. Secondly, dismissal of the workman for pulmonary symptoms is very unlikely, as white labor is scarce, and therefore dismissal will hardly be practised before actual incapacity results. Thirdly, there was only one industry to consider, the Rand gold mining industry.

The principal act was passed in 1912 and was amended in 1914–1915. It provides for the establishment of two funds to which employers, workmen, and the state contribute, from which benefits are paid, and which are administered by a state-appointed board. The principal fund is the industrial fund to which the employer contributes $7\frac{1}{2}$ per cent. of the wages paid by him to miners, but recovers $2\frac{1}{2}$ per cent. from the worker. In addition, there is a compensation fund for cases in which application for benefit is made within two years of the commencement of the act and to this the government contributes, but this fund need not detain us as it is the insurance fund which bears the brunt of the compensation to be paid. The funds are administered and awards made (except in the case of native labor) by a miners' phthisis board appointed by the government. This now consists of seven members. The board is also empowered:

1. To acquire small holdings and establish beneficiaries and others on them.
2. To assist industrial undertakings which employ beneficiaries and their dependents.
3. To establish labor bureaus for obtaining employment for such persons.
4. To defray travelling expenses of beneficiaries to places of employment.
5. To collect statistics, etc., as to phthisis and the results of granting benefits.

Half the cost of (1) and (2) up to £20,000 a year is defrayed by the state. These additional duties were imposed on the board in accordance with the recommendation of a select committee that steps should be taken to obtain employment outside the mines for early cases and to combat the prejudice of employers against them. Most beneficiaries, they say, want work, not money.

All applicants for benefit are examined by members of a special medical bureau whose decision on purely medical questions is final. The bureau is paid partly by the

state and partly from the insurance fund. It was found desirable to place the examination of applicants in the hands of a few experts, chiefly with a view to avoiding divergencies of practice in examination. Under the regulations all examinations of "miners" take place, except in special cases, at the Institute for Medical Research and x-ray photographs are to be used at all such examinations. The bureau also conducts or controls all other examinations held under the act.

The extent to which physical capacity for work is impaired is the criterion for compensation, and not inability to earn full wages. The reason for this is that actual incapacitation from work at the usual wages occurs in the case of miners' phthisis at a very late stage in the disease, and that it is desirable to award benefit to the workman as soon as possible after, if not before, his capacity for work is impaired, and not to offer him any inducement to remain in the mines until he is absolutely incapacitated.

Every person desiring to enter for the first time upon work underground in a scheduled mine must, before he can be employed, obtain a certificate that he is free from any disease of the lungs and respiratory organs, and that he is physically fit for underground work. Further, a six-months examination of every person working underground is required, so as to make effective the law forbidding persons suffering from tuberculosis from working underground. No compensation for pure tuberculosis, seeing that it is not an occupational disease specific to the employment, is provided in the act. The contributions to the insurance fund amounted to £270,000 a year, representing $2\frac{1}{2}$ per cent. on the average working profits.

In New Zealand an attempt was made under the Workmen's Compensation Act of 1908 to include pneumonoconiosis (as affecting miners only) among the industrial diseases to which the act applied. In order to safeguard themselves to some extent against the liabilities imposed by the act, and as regards the liability to pay compensation in respect to pneumonoconiosis in particular, certain mine owners set up a system of medical examinations of employees and applicants for employment. Insurance companies refused to insure employers unless such a medical examination was established. The men objected very strongly to the examination (they actually laid the mines idle), alleging that it was degrading and meant that the less fit men would be out of employment, and further that it was abused as a means of getting rid of "troublesome" employees. It was also felt that the employers who first established such examinations were taking an unfair advantage of others by transferring to them the risk due to the employment of the less fit men. Subsequently, it was made illegal for the management to require employees or applicants for employment to be examined medically or to produce a satisfactory certificate. To make up for this, the employers pressed for the exclusion of pneumonoconiosis from the Workmen's Compensation Act and this was done. It may be observed that the disease was and apparently still is rare in New Zealand and that no claim for compensation in respect to it was made during the time the disease was under the act. Later, in 1915, what seems an extremely wrong principle was embodied in the Miners' Phthisis Act, when provision was made by the state to compensate miners incapacitated from work by miners' phthisis, as it holds out an inducement to continue in the mines until the disease is very advanced.

The way in which the compensation is now granted for fibroid phthisis in Great Britain is under an act called the Workmen's Compensation (Silicosis) Act of 1918. Under its terms, schemes can be provided

for payment of compensation by the employers of workmen in any specified industry or group of industries or processes involving exposure to silica dust, in the case of men affected by silicosis of the lungs or silicosis accompanied by tuberculosis. The scale of compensation fixed by the scheme in the case of death or total disablement is that prescribed by the Workmen's Compensation Act of 1906. Provision is made in the act for establishment of a general compensation fund, for requiring employers to subscribe to the fund, and for the payment and recovery out of the fund of all compensation and of any expenses arising under the scheme. Provision is also made for payment and remuneration of medical officers and advisory medical bodies, and for requiring workmen to submit themselves to periodic examinations (not oftener than once a year) and to furnish information with respect to previous employment in which there has been exposure to silica dust. Provision is also made for suspension from employment of workers who are found to be suffering from silicosis or from silicosis accompanied by tuberculosis. The first scheme has been prepared and made applicable to the refractory industries, and to all processes in, or in connection with, cutting, handling, breaking, crushing, grinding of material containing not less than 80 per cent. of silica, and in the manufacture of bricks or other articles made with silica. There are other occupations to which no doubt, in time, a similar scheme will be applied, as for example, dressing and grinding of sandstone wheels, grinding articles on sandstone wheels, and processes in pottery manufacture in which powdered flint is used. In this way such very large industries as the grinding of cutlery articles and stone-masons' work will be brought within the act.

POISONS IN THE RUBBER INDUSTRY*

The Rash Produced by Hexamethylene-Tetramine and a Means of Prevention

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THOUGH the occurrence of a rash among rubber workers has long been observed it is only recently, since the introduction of organic accelerators of vulcanization, that the skin eruption or dermatitis has been at all serious or prevalent. By 1917, however, the problem had become so general that the Rubber Section of the American Chemical Society requested its Committee on Organic Accelerators to investigate the toxic properties of the more commonly used accelerators. The report (1) of this committee which was presented in September, 1918, at the Cleveland meeting of the society brought out the fact that most of the common accelerators had distinctly poisonous properties. The report covered aniline, paraphenylenediamine, thiocarbanilide, p-nitroso dimethylaniline and hexamethylene-tetramine; it emphasized the necessity of studying accelerators not only from the standpoint of the accelerating action but also as regards poisonous properties.

In the study of accelerators, the Firestone Research Laboratory has devoted much attention to the question of toxicity, with the purpose of finding an accelerator combining excellent acceleration with a minimum of toxic action. Knowing that many rubber companies are using hexamethylene-tetramine or "urotropin," it was thought that a study of the toxicology of this substance would be of interest not only to ourselves, but also to those who are already using this accelerator. The investigation has been extended to cover the probable cause of its action and to find, if possible, an antidote or simple means of prevention.

The action of hexamethylene-tetramine was summarized in the Report of the Committee on Accelerators as follows:

> *Symptoms of Poisoning.* — Rash and inflammation of skin which has been in repeated contact with stock containing this material. In severe cases, blisters filled with watery fluid result.
>
> *Antidote.* — Cleanliness and care in regard to clothing are the best preventatives. Change of occupation will cause the rash to disappear, leaving no permanent effects.

This description agrees closely with that taken from the United States Dispensatory (2) in which it is stated that, "Locally, hexamethylene-tetramine is mildly irritant and feebly antiseptic." "A measles-like rash with much itching has been noticed after its continuous use."

In order to study the nature of the irritation ascribed to this accelerator, the tetramine was applied in powdered form and in water solution of various concentrations to different parts of the body. Five men from the Research Laboratory were selected for these tests and applications were made on the wrist, forearm, chest and thigh. These applications were repeated several times each day for several days, yet there was no irritation or indication of rash in any case and not even the slightest itching. Thinking that possibly the perspiration might function in the production of this rash, applications were made on the feet and even under the armpits, where the perspiration flows most freely. Again, no action could be observed. Even applications following a very hot bath, thoroughly opening the pores and

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causing a typical "sweat," resulted in no irritation whatsoever.

As a result of these negative experiments, it was decided to introduce this accelerator into a factory compound in order to study its effect upon actual working conditions. The workmen handling this particular experimental stock were carefully observed. At the time this test was begun the weather was quite cool and for some time no deleterious effect was observed. However, with the approach of warmer weather the action of hexamethylene-tetramine began to manifest itself. It usually appeared first as a rash on the wrist or forearm, and in many cases was confined to these parts. The action became more pronounced, however, when really warm weather arrived; not only the forearms, but also the face and neck became involved and to such an extent in certain cases that a large portion of the face was affected, especially around the eyes. In general the inflammation was confined to the exposed parts, though occasionally it appeared on the shoulders, legs and even across the stomach. There seemed, however, to be no tendency for this rash to spread to any great extent beyond the parts which actually came in contact with the stock; the cases on the face and neck probably resulted from contact with the hands.

The dermatitis produced by contact with the stocks containing hexamethylene-tetramine was identical with that described by Kratz (3) in an article on the "Control and Prevention of a Rash Among Rubber Factory Employes," though his paper mentions no particular accelerator or other substance as the cause of the rash. Quoting from this article:

> The rash almost invariably appears as a simple erythema, such as is generally attributed to the heat. This condition is closely followed by the appearance of sac-containing eruptions or vesicles similar to those characteristic of ivy poisoning. These vesicles are quite small, seldom being larger than pin-heads and are grouped in varying arrangements, from being widely disseminated, to quite closely aggregated. They rarely retain their integrity for more than 48 hours, being broken by friction from the clothes or by the patient's rubbing and scratching, or, if this does not occur they soon become filled with a watery serum and rupture spontaneously in consequence of the exuded fluid.

The perspiration undoubtedly plays an important part in the production of this rash. It becomes almost epidemic with rise in temperature. Following a few hot or sultry days productive of profuse perspiration, a marked wave of rash will spread among the men handling the raw hexamethylene-tetramine stocks; a few cool days and it subsides, only to reappear again when the hot weather returns. This observation also agrees with that of Kratz, who writes:

> Though the rash is most prevalent during hot weather, particularly in humid midsummer, it certainly cannot be attributed solely to the heat; nevertheless the abnormal perspiration produced by the heat undoubtedly does play a part in rendering the skin most tender and susceptible to infection. Throughout the factory the fundamental cause of the rash will probably be traced to the irritation produced by the careless handling of green stocks or liners.

On studying the situation closely for several months and during the hottest weather, a marked immunity to the action of the hexamethylene-tetramine was observed. Only a small percentage of those handling the stock were affected. One would find next to an especially virulent case, men performing exactly the same operations and handling the same stock, absolutely free from any sign of irritation. This undoubtedly explains the negative results which were obtained in the laboratory when the strong solutions of hexamethylene-tetramine were first applied. In order to prove that the hexamethylene-tetramine was really responsible for the trouble, a patient was selected for experimentation from among those who had shown themselves susceptible to this rash.

This patient had had the rash very severely for nearly two months, the hands, wrists, forearms, face and neck all being involved. The part selected for the test with the concentrated accelerator was the arm above the elbow, where the skin was perfectly clear and where the patient said he had never had any rash. An application of a 50 per cent. water solution of hexamethylene-tetramine was made by moistening six plies of sterile gauze bandage with the solution and securing it with bandage and adhesive tape. This method of application was selected to insure constant contact with the skin and at the same time protect the treated spot from contamination with other substances. In the course of twenty-four hours, an eruption developed on the treated surface having all the characteristics typical of the "rubber rash." The other arm above the elbow was similarly treated, with the same result at the end of twenty-four hours. During these tests the forearms, face and neck on which the patient had previously had the rash were clearing up, showing that the rash above the elbow was not due to spreading from the forearms. No more applications were made for a period of eight days, at the end of which time the skin above the elbows had returned to its normal condition. Again, hexamethylene-tetramine was applied in 50 per cent. solution and again the rash was reproduced above the elbows. Two other patients susceptible to rash were similarly treated with this 50 per cent. solution; in both cases a rash was produced. All these tests were conducted while the weather was warm and the patients perspired freely while working. These results were so clean cut that they left little doubt as to the irritating action of hexamethylene-tetramine.

The absence of any rash, even on the hottest days, among those who handled the cured stock was very pronounced; as far as the writers are aware, not a single case was reported. In view of the recent work of Bedford and Scott on the "Reactions of Accelerators during Vulcanization" (4), this is readily explained. These investigators have shown that hexamethylene-tetramine reacts with sulphur at the vulcanization temperature, forming among other things, hydrogen sulphide, carbon bisulphide, ammonia and a sulphocyanate.

In order to determine a suitable substance to use as a preventive, an explanation of the mechanism of the action of hexamethylene-tetramine was sought. As the occurrence of rash is closely associated with the excretion of perspiration, the possible chemical changes which might result from its action on hexamethylene-tetramine were investigated. According to Schamberg (5) the perspiration is normally acid; this has also been demonstrated by actual tests by the writers. It is well known that hexamethylene-tetramine is readily decomposed by acids. Hartung (6) has shown that warming with strong acids results in the formation of formaldehyde, and more recently, Ischidzu and Inouye (7) have demonstrated that the weaker acids such as acetic, lactic and succinic acid bring about the same result; these investigators also showed that hexamethylene-tetramine is decomposed to some extent even on boiling the aqueous solution. Its use as a bladder antiseptic depends on the liberation of formaldehyde in the bladder due to the presence of acids in the urine; Suder (8) has shown that when the urine is alkaline this decomposition does not take place. It seems a logical conclusion, therefore, that when hexamethylene-tetramine is absorbed by the skin, formaldehyde will be produced in the pores under the influence of the sweat acids.

The corrosive and toxic action of formaldehyde has long been known. Remington and Wood (9) state that formalin is an intense local irritant both to the mucous membrane and, if in sufficient concentra-

tion, to the skin. It has been the writer's experience, however, that the action of a solution of formaldehyde is quite different from that produced by hexamethylene-tetramine. Application of 40 per cent. formalin produces a hardening of the skin followed by a scaly appearance due to cracking of the surface. This eventually peels off, leaving the lower skin perfectly clear. There is no reddening of the skin, nor any itching sensation.

Formic acid, on the other hand, is extremely irritative to the skin. On making an application of the strong acid, severe smarting and itching occur almost immediately, followed shortly by the production of a blister. After twenty-four hours the blister subsides and the affected spot has a pus-like appearance. A thick scab slowly forms and quite a perceptible scar remains after the sore has healed, showing that the acid burns quite deeply. The action of the formic acid resembles very much that of hexamethylene-tetramine, only very much intensified.

This study of the respective effects of formaldehyde and formic acid on the skin has led the writers to believe that the action of hexamethylene-tetramine is due to the formation of formaldehyde in the pores under the influence of the sweat acids, followed by subsequent oxidation of the aldehyde in the pores to formic acid, and that the latter is the active irritant. Though there is no proof that such an oxidation does occur in the pores of the skin, such an action seems not so improbable when it is considered that formaldehyde has been shown to be oxidized rapidly in the system, appearing in the urine as formic acid (9). The reason for the difference in action of formaldehyde as such and formaldehyde generated from hexamethylene-tetramine may be attributed to difference in absorption. Hexamethylene-tetramine is extremely soluble in water (1 part dissolves in 12 parts of water at 12°C.) which permits of rapid absorption through the pores. Formaldehyde, on the other hand, though very soluble in water, when applied to the skin quickly hardens the surface, making it impervious to further absorption. In fact, this property of formaldehyde has been utilized for the purpose of checking excessive perspiration (9).

On the assumption then that the acid of the perspiration is the primary cause of the rash, neutralization of this acid should prove an effective preventive, and furthermore, if the actual irritant is formic acid, neutralization of this would prevent its action, if it were formed. Any substance used to obtain this result should be itself non-irritating to the skin, preferably neutral in character, and sufficiently soluble in water to be easily absorbed by the skin. Sodium bicarbonate or "baking soda" meets all these requirements. It is neutral, quite soluble in water (100 parts of water dissolve 9.6 parts of the salt at 20°C.) and non-irritating, and consequently was selected for experimentation as a preventive means.

In applying the sodium bicarbonate, the method of treatment employed consisted in first thoroughly washing the affected part with soap and water, drying and then applying a saturated solution of the bicarbonate, allowing this to dry without wiping. The thorough washing opens the pores of the skin and allows better penetration of the bicarbonate wash. On drying, a white film of the salt remains as a thin coating which adheres with surprising tenacity. Two applications daily were made, at the beginning and at the middle of the shift. Before leaving the factory the affected parts were washed and no further application made at that time.

The first patient on whom this treatment was tried responded rapidly. The solution was applied to the arms, face and neck, all of which parts were affected. In the course of a week all the rash had completely disappeared, and what was of chief interest,

no new eruptions had developed. Since the weather was fairly cool during this period, it might be concluded that this was the cause of the rapid disappearance of the rash. To prove otherwise and eliminate the temperature factor, the use of the wash on the left arm was discontinued while continuing the application to all the other exposed parts; five days later the left arm, and the left arm only, was broken out with the typical rash. Thinking possibly that this might be due to more frequent contact with this arm with the stock, the treatment was omitted from the right arm and again continued on the left. Four days later an eruption appeared on the right arm, while all the other parts treated with bicarbonate were entirely free from any dermatitis. This patient used bicarbonate for a period of four weeks and during that time had no sign of rash except on the forearms when the wash was omitted as previously mentioned. Before using bicarbonate, this patient had had the rash on some exposed part of his body almost continuously for nearly three months.

A squad of ten men was selected for further tests as to the efficacy of the bicarbonate solution. These men, selected from the various departments handling this stock, had all been troubled more or less severely with rash. This squad was supplied with the bicarbonate wash and carefully observed from day to day during a period of two weeks. All, without exception, showed marked improvement; the old rash healed rapidly and no new eruption developed. During the course of these observations there were several very warm days, which brought on quite a wave of rash among those not being treated. Not one member of the squad, however, developed any rash during this hot spell.

On the strength of these results bicarbonate solution was provided, so that all the men handling the raw stock containing the hexamethylene-tetramine could obtain it if troubled with this rash. Though it was not possible to obtain as accurate data on all those applying the solution, the reports obtained from both the foremen and the men using the solution were very encouraging.

At the Eighth Annual Congress of the National Safety Council held at Cleveland on October 4, 1919, a representative of the Hood Rubber Company stated that they had had very considerable success in combating this rash by using an aqueous solution of borax containing gum arabic. He stated that this mixture dried with some difficulty, and they had installed electric dryers to obviate this trouble. Though the writers have not had opportunity to test this treatment, they feel that the bicarbonate solution offers a much simpler treatment; it dries readily, is free from the alkaline reaction of borax and in addition costs very much less.

While it is true that the necessity for the application of any preventive or prophylactic solution, such as bicarbonate of soda or borax, is a serious drawback to the use of a substance as an accelerator, it does not prohibit its use. It offers a better solution of the difficulty certainly than that offered by the Committee on Accelerators. "Change of occupation," with the entailed loss of wages and curtailed production, can scarcely be considered a satisfactory antidote, either from the standpoint of the employee or employer.

The use of the bicarbonate solution is attended with no disagreeable results. When first applied to a severe case there is considerable smarting, but this soon stops after the solution has dried and the patients report that the severe itching which always accompanies this rash is relieved within a few hours, and there is a marked improvement in the appearance of the skin after twenty-four hours. The solution can be applied to the face and neck and even around the eyes with perfect safety. This

is of particular importance, as some of the most severe cases are those in which the face, especially around the eyes, is affected. A case which recently came within the observation of the writers was that of a man whose entire face was inflamed to such an extent that both eyes were completely closed. Not only was the face affected, but also the arms, shoulders and legs. This case was so severe that it was found necessary to put the patient to bed. Four hours after the first application the inflammation had subsided, the patient stated that the itching sensation was practically gone and he was able partially to open his eyes. At the end of ten hours he was quite comfortable and slept through the entire night. This was quite remarkable for those suffering from the rash complain chiefly of being kept awake at night. Thirty hours after the first treatment he had sufficiently recovered to be discharged from the hospital.

Though the bicarbonate has an apparent curative effect, it is unquestionably chiefly preventive. The case just cited seems to contradict this, but the writers feel that the curative action was simply due to arresting the further action of the absorbed hexamethylene-tetramine. The chief interest in this treatment is the fact that further development of new rash is prevented, and the old rash is thus allowed to heal without further infection.

These observations are published with the realization that they represent the action of bicarbonate on a comparatively small number of cases, but the results seem to justify the conclusion that bicarbonate can be used successfully in controlling the hexamethylene-tetramine rash.

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BOOK REVIEWS

The Action of Muscles. Including Muscle Rest and Muscle Re-education. By William Colin Mackenzie, M.D., F.R.C.S., F.R.S. (Edin.), Member of the Council of the Anatomical Society of Great Britain and Ireland and of the Staff of the Military Orthopedic Hospital, Shepherd's Bush, London; formerly Lecturer on Applied Anatomy to the University of Melbourne, and Examiner in Senior Anatomy to the Universities of Melbourne and Adelaide. Cloth. Pp. 267, with illustrations and index. New York: Paul B. Hoeber, 1918.

This is a comprehensive study of muscle as an organ of motion. Great emphasis is laid on the mechanical factors generally overlooked by physicians. For instance, the joints of the body are described as levers of the first, second and third orders according to physics, and figures are given showing examples of each order and explaining the special mechanical advantages of each.

The most practical part of the book is that describing muscle rest, in which a new point of view is brought forward that rest is the essential treatment for paralysis and that the old fallacy that we must do something to the muscle to maintain its nutrition would appear to be dying as hard as the one that by resting a joint its liability to ankylosis is increased. It is even claimed that rest is essential for the repair of the nerve cells connected with the muscle, and that massage and electricity interfere with recovery.

The "zero position" is described as that position in which the antagonistic muscles at a given joint are at equilibrium, and are so balanced that neither has a mechanical advantage over the other. This intermediate position is the ideal one for rest, and whenever a muscle is paralyzed the antagonist must be kept from overaction by placing the joint in this zero position by means of splints. Many such splints are illustrated in the text and examples of war wounds are shown. In testing for the presence of voluntary motion in a muscle, it is imperative that the muscle should first be put in this zero position, otherwise slight voluntary motion may be present but not elicited on account of gravity, friction, or the overaction of the antagonist, masking the slight power of the muscle tested. For example, in deltoid paralysis the patient should be lying flat with his arm on a smooth, powdered surface, so that abduction can take place without working against either friction or gravity, and the pectoralis major must not be allowed to contract and thus counteract this abduction.

Many references are made to comparative anatomy, and the author shows a wide knowledge of the myology of marsupia's. The arguments are, however, often teleological and not convincing. Special muscle groups are thoroughly discussed: the shoulder region, the muscles of the thigh, muscles acting on the leg, muscles acting on the foot, are all taken up in detail, and special nerve paralyses are described and methods of treatment outlined.

If the physiological contentions can be borne out by experiment, the book is a most useful one, for the methods of treatment given seem to have stood the test of trial and to have given better results than older methods. For anyone desiring to acquaint himself with the specific function of any muscle or group of muscles the book is valuable. — *Stanley Cobb.*

The Organization of Public Health Nursing. By Annie M. Brainard, Editor-in-Chief, Public Health Nurse, Cleveland, Ohio. Cloth. New York: The Macmillan Company, 1919.

The Organization of Public Health Nursing, recently brought out by The Macmillan Company, is a book that will prove of interest to community workers everywhere. To public health nursing associations it is exceedingly valuable for in it Miss Annie M. Brainard has collected and presented recent methods of managing the community health work which falls so largely to the charge of the visiting nurse, whether in her capacity of district nurse, school nurse, tuberculosis nurse, industrial nurse, or well-baby nurse. In her introduction Miss Mary Gardner says: "If the public health nurse is to fill adequately the important position in this general public health movement now assigned to her, an increasing effort must be made to so organize her work as to remove all unnecessary friction from the wheels of administration. Miss Brainard, after a long experience in the public health nursing world, in a city notable for its organized health effort, is in a position to state clearly not only the general principles underlying all forms of systematized organization, but is also able to place at the disposal of those unused to such work, valuable

suggestions regarding simple matters of detail on which depend success or failure."

Without an intimate knowledge of public health nursing, one can hardly appreciate how little uniformity of administration for any type of such nursing is in existence. For instance, school nurses in one large city are directed under a totally different policy from that of another city, and it may be, by quite another department of the municipal organization — the department of health and the board of education, for example, each claiming the responsibility.

Miss Brainard says: " First of all there is the National Organization for Public Health Nursing, which in a certain way forms a background for all the work carried on in any part of the country. I say ' in a certain way,' for it is not like the organization of Queen's Nurses in England, nor the similar Victorian Order of Nurses in Canada. It does not train the nurses, nor does it employ them or supervise their work. There is no central authority. Membership in the National Organization for Public Health Nursing carries with it nothing beyond a recognition of standard, and the Organization itself is purely one for upholding these standards; giving help and advice to individuals or communities; assisting in the spread and establishment of Public Health Nursing; and for keeping up an historical record of the work and its growth."

As we go on reading we are led not only to review established methods of organization with valuable detailed accounts of the many committees which such organization implies, but also to look ahead to the broad new implications of public health nursing development. Such a looking ahead is found in the treatment of advisory committees of lay persons sometimes attached to city or state departments of health (Chapter III, p. 30 and Chapter VI, p. 64); such is the treatment of school nursing, in relation to the health administration; and of the importance of making a close affiliation between departments of health (local, state, or federal public health service) and all other public health nursing organizations, even though they are privately controlled.

The question of " generalized " nursing is discussed (Chapter III, p. 25), and " in theory at least " it is conceded that the " ideal plan for public health nursing in a city " is to have " one nurse in a small district, under one central control with specific supervision of specialties."

In a rather unusual way this book has dealt with many small concerns of public health nursing administration and has never at any time submerged the greatness of the cause in these details. We lay the book down with a distinct desire to be a part of that organization upon which the value and success of public health nursing so largely depend. — *Mary Beard.*